

## ARTICLE

# Effects of the added sugar labeling on consumers' willingness to pay: The case of cranberry products under different nutrition-related information treatments

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## Abstract

The Food and Drug Administration announced a rule update to the Nutrition Facts Panel (NFP) requiring the declaration of added sugars on the NFP starting in 2020. This study measures the impact of these changes by estimating the willingness to pay for added sugars in cranberry products under different nutrition-related information treatments. We found significant discounts for increases in added sugars that vary across information treatments and consumer subsamples. A positive information frame about the health benefits of cranberries was not found to consistently offset the impact of additional information on the recommended daily intake limits for added sugars.

## KEYWORDS

consumer behavior, health-related information, labeling policies, willingness to pay

## JEL CLASSIFICATION

D12, I18

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## 1 | INTRODUCTION

Policies mandating the nutritional labeling of packaged foods and beverages have promoted consumers' informed food choices to increase the consumption of healthy foods and deter the consumption of foods containing unhealthy ingredients. Past labeling initiatives successfully reduced the intake of nutrients such as sodium and trans fats (Shangguan et al., 2019). Like other ingredients of health concern, Americans' intake of added sugars generally exceeds the recommended limit of less than 10% of calories consumed (US Department of Agriculture, 2020). To curtail this overconsumption of added sugars—particularly from sugar-sweetened beverages—the Food and Drug Administration (FDA) issued a rule update to the Nutrition Facts Panel (NFP) in 2016 requiring the declaration of added sugars with their corresponding percent daily value directly below “Total Sugars” on the NFP of packaged foods (US Food and Drug Administration, 2019). Previously, only “Sugars”—without distinguishing whether sugars were naturally occurring or added during processing—were shown on the NFP.

Cranberry products make an interesting case study to analyze the effectiveness of labeling policies, specifically the added sugar rule. First, cranberries contain phytochemical components with proven positive effects on human health (Bodet et al., 2008; Neto, 2007; Pappas & Schaich, 2009; Raz et al., 2004). Second, processed cranberry products require added sugars to improve their palatability due to the fruit's high acid and low natural sugar content. Consequently, the new FDA-added sugar labeling concerns the US cranberry industry as it could lead consumers to perceive cranberry products as less healthy than comparable products made from fruits that are high in natural sugars—despite having a similar amount of total sugars per serving—but without the added sugar line in the NFP (US Food and Drug Administration, 2019). To mitigate this potential negative impact, the FDA exercised discretion in allowing the use of a footnote on the NFP of certain cranberry products explaining that sugars are added to improve the palatability of naturally tart cranberries (US Food and Drug Administration, 2019). In addition, the cranberry industry proposed the inclusion of health claims on their labels to mitigate the potential adverse effect of the added sugars labeling on consumers' perception of cranberry products. In July 2020, the FDA announced its intention not to object to the inclusion of specific health claims on the labels of some cranberry products (Van Laack, 2019; US Food and Drug Administration, 2021).

In this context, a research question with significant policy and industry implications is how different pieces of information on a food label interact and influence food demand. The contribution of this study is focused on estimating the impact of the new added sugar rule on cranberry products and measuring the impact of the rule under different information treatments to provide insights as to how displaying health messages on a product's label might mitigate or intensify the effect of the added sugar line on the NFP.

This study assesses how reporting added sugars on the NFP of packaged cranberry products affects consumers' purchasing decisions. First, we estimated the marginal willingness to pay (WTP) for added sugars in dried cranberries and cranberry juice. Second, we evaluated the effect of information treatments (i.e., information about the health benefits of cranberries and recommended daily intake for added sugars) on the WTP estimates to investigate further if the information on health benefits associated with cranberries mitigates the impact of the added sugar label. In other words, we want to test if the FDA's intention to allow the inclusion of specific health claims on the labels of some cranberry products would mitigate the potential negative impact of reporting added sugar on the label (US Food and Drug Administration, 2021). We explore if information scripts about the health benefits of cranberries mitigate the negative impact of added sugars information. Third, we investigated sources of heterogeneity in the distribution of WTP for added sugars by analyzing the distributional effects of added sugars on consumers' WTP across risk groups the new NFP labeling rule and similar health policies are purported to impact.

This study extends the research on the impact of added sugars on purchase intention by estimating survey respondents' WTP when presented explicitly with the added sugars content. The

contribution of this study is to increase the understanding of the effectiveness of added sugar labeling policies and the potential unintended consequences of labeling mandates, such as creating a negative perception of a food product like cranberries, whose consumption is associated with health benefits. Also, given that sugars from concentrated juices do not meet the definition of added sugars in certain circumstances under the current NFP labeling requirements, our study provides insights regarding consumers' WTP for products sweetened with natural juices. The cranberry products included in this study were selected due to their importance (in terms of sale volume) for the cranberry industry—for example, 97% of cranberries are sold processed in the form of juice or juice blends (US Department of Agriculture, Economic Research Service, 2021).

## 2 | BACKGROUND

The extent to which food labels can change consumption behavior depends on how consumers use and value this information. Previous studies have analyzed consumers' attention to NFP, emphasizing added sugar information. Findings indicate that nutrition information and the added sugar content are not well attended (Thunstrom et al., 2016). Other studies conclude that attention to the added sugars line on the NFP differs across products and individual consumers. Avoidance of the added sugar information was observed to be more prevalent for nonhealthy products such as ice cream (Kim et al., 2021). Also, health-conscious consumers are more sensitive to NFP changes in products such as yogurt (Fang et al., 2019).

In addition, studies have found that consumers often misunderstand the meaning of added sugars on the NFP. Laquatra et al. (2015) concluded that consumers interpreted the “Added Sugars” line as being in addition to—and not a part of—the amount shown in the “Sugars” line on the NFP and deemed products with the added sugars line as being less healthy than a product with the same NFP but no added sugars information. It is possible that additional nutrition information on food labels neutralizes its intended effect (Berning et al., 2008) and even lead to unintended consequences (Khandpur et al., 2020). Other studies proved that even if consumers display a limited understanding of the added sugars information on the NFP, their ability to recognize the different types of sugars is positively correlated with the frequency of label usage, interest in nutritional issues, and education (Tierney et al., 2017).

Information on added sugars has been found to influence purchase intention. A study found that consumers were more likely to buy juice when the new NFP displayed 0 g of added sugars than juice with an NFP displaying only total sugars (Khandpur et al., 2020). Other studies have concluded that negative nutrition information on food labels can have a more salient effect on consumers' choices than positive information (Jo et al., 2016). Studies have found that consumers pay more attention to the information on the NFP when a food's healthfulness is ambiguous, as opposed to products consumers consider either healthy or unhealthy (Graham & Jeffery, 2012; Grebitus & Davis, 2017).

Our study explores the effects of health claims and recommended sugar intake limits on the WTP for added sugars. Previous findings are mixed. While one study found that consumers' visual attention to health claim labels were a poor predictor of respondents' subsequent food choices (Fenko et al., 2018), most studies found a significant effect. Meta-analyses by Shangguan et al. (2019) and Kaur et al. (2017) found that overall health-related claims have a substantial effect on dietary choices. These findings are consistent with studies revealing the efficacy of easy-to-understand health claims labels on the consumption of healthy foods (Hwang et al., 2016; Zafar et al., 2022). Aligned with easy-to-understand labels, Carrillo et al. (2014) found that health-claims' symbols were more impactful than verbal health-related information. Another study found that the health-related symbol and the verbal information were more impactful than presenting the symbol alone (Miklavac et al., 2021). Closer to our study are the findings by Mediano-Stoltze et al. (2021), who analyzed if consumers misinterpret the information on the nutrient content label of a perceived

healthy food in view of warnings on excessive nutrients such as added sugar, saturated fats, and sodium. They found that warnings had a negative effect on consumers' perceptions irrespective of the nutrition content information, dampening any halo effects.

Our study goes beyond previous research by introducing information treatments and assessing their impact on different consumer sectors. Unlike past studies, our study is the first to analyze mitigation strategies for the potential effect of labeling mandates on consumers' perceptions by estimating how different information treatments affect the WTP for the added sugar line on the NFP of cranberry products.

### 3 | METHODOLOGY

Data used in this study was obtained via a survey. The sample of respondents came from the consumer panel administered by Qualtrics Research Services<sup>TM</sup>. The survey involved four different information treatments for dried cranberry and cranberry juice, making a total of eight survey versions. Qualtrics supplied 250 nationwide respondents for each survey version, totaling 1000 responses for the dried cranberry survey and 1000 for the cranberry juice survey, making a total of 2000 respondents. A detailed description of the recruitment procedure can be found in Supporting Information S1: Appendix A.

The survey was approved by the Mississippi State University Institutional Review Board, IRB number IORG0000467. The surveys were pretested during a soft launch in November 2020, and data collection took place from December 2020 through March 2021. All survey versions included the discrete choice experiment (DCE) to elicit consumers' WTP for cranberry products.

#### 3.1 | Choice experiment design

We opted for DCE over other preference elicitation methods because these methods are consistent with Lancaster's demand theory (Lancaster, 1966) and enable researchers to examine several attributes simultaneously in a controlled environment. This is an advantage over secondary data, as the researchers cannot control all the factors influencing the purchase decision. For this specific study, even though cranberry processed products have been in the market for several years, compliance dates for the added sugar regulation only started in 2020, which limits the availability of market data to measure the variable of interest in a meaningful manner. Further, compared to other stated preference elicitation methods such as contingent valuation, DCE allows for a large number of observations on choice from a relatively small number of respondents, and DCE questions closer resemble actual choice environments, making them less prone to hypothetical bias (Louviere et al., 2000).

Respondents completed one set of DCE questions in the dried cranberries survey version. In the cranberry juice survey version, respondents were presented with two DCEs—one for unlabeled juice and a second with labeled juice categories. The attributes included in the DCE are the added sugar content per serving, the method to achieve the desired, and the price levels reflecting current market prices (Table 1). We generated a D-optimal experimental design based on the multinomial logit model and using zero prior parameter values in NGENE version 1.2 (ChoiceMetrics, 2018). A design was developed for each of the DCEs (dried cranberries, unlabeled cranberry juice, and labeled cranberry juice) to reflect their specific attributes and utility functions. We tested different combinations of choice tasks and blocks and attribute level balance in selecting the final design. Each of the DCEs consisted of 18 choice scenarios divided into three blocks of six choice scenarios each with a D-error of 0.08, 0.08, and 0.13 for the dried cranberries, unlabeled juice, and labeled juice, respectively.

**TABLE 1** List of attributes and attribute levels for sets of discrete choice experiment scenarios for dried cranberries, unlabeled juice, and labeled juice.

Attributes	Alternative possibilities available for each attribute <sup>a</sup>		
	Dried cranberries survey	Unlabeled juice	Labeled juice 100% juice
Added sugars <sup>b</sup>	0 g	0 g	0 g
	12 g	12 g	12 g
	23 g	23 g	23 g
Method used to achieve desired sweetness	Addition of regular sugar	Addition of regular sugar	Addition of other fruit juice from concentrate
	Addition of other fruit juice from concentrate	Addition of other fruit juice from concentrate	Addition of the combination of regular sugar + other fruit juice from concentrate
	Addition of the combination of regular sugar + other fruit juice from concentrate	Addition of the combination of regular sugar + other fruit juice from concentrate	Addition of the combination of regular sugar + other fruit juice from concentrate
Price	\$1.99/6-oz. bag	\$2.49/64-fl. oz. bottle	\$3.49/64-fl. oz. bottle
	\$2.69/6-oz. bag	\$2.99/64-fl. oz. bottle	\$3.69/64-fl. oz. bottle
	\$3.69/6-oz. bag	\$3.49/64-fl. oz. bottle	\$3.69/64-fl. oz. bottle

<sup>a</sup>The attribute levels were selected based on a comprehensive exploration of market prices and the sugar content in commercial dried cranberry products and cranberry juices.

<sup>b</sup>Added sugar per serving reported on the Nutrition Facts Panel. One serving is equivalent to 1/4 cup of dried cranberries and 1 cup of cranberry juice.

In the dried cranberries survey, each respondent evaluated six choice scenarios containing two 6-oz. bags of dried cranberries with varying attribute levels (Option A and B) and an opt-out alternative. The juice survey included two sets of DCE scenarios. In the first DCE set, each respondent was asked to complete six choice scenarios containing two options of unlabeled 64-fl. oz. bottles of cranberry juice (Option A and B) and an opt-out alternative. In the second DCE set, respondents were presented with an additional six choice scenarios with three labeled options—"100% Juice," "Cocktail" (this is the nonalcoholic cranberry juice option that contains less than 100% juice), and "Blend"—and an opt-out alternative. The inclusion of two different DCE question sets in the survey, one for unlabeled and another for labeled cranberry juice serves to assess how respondents' preferences might differ when presented with generic juice scenarios versus scenarios where different types of juices are specifically identified.<sup>1</sup> The instructions for the labeled juice DCE included a description based on industry guidance and consultation with industry stakeholders. The detailed description of the introductory narrative and an example of a choice scenario can also be found in Supporting Information S1: Appendix B.

To construct the DCE experimental design for the labeled fruit juices, the study followed the FDA's added sugar labeling rule and industry guidance governing the labeling of juices (US Food and Drug Administration, 2020). For example, because the 100% juice declaration only applies if the juice has other ingredients that do not reduce juice soluble solids (US Food and Drug Administration, 2020), then a juice sweetened with sugars only could not be labeled "100% juice." Similarly, because the "Cocktail" and "Juice Blend" have juice, water, and allows for the addition of regular sugar, then the option of being sweetened only with fruit juice from concentrate was not a valid option for these two alternatives. In addition, we restricted the combination of 0 g of added sugars when regular sugar appeared as part of the sweetening method in the experimental design. Whether fruit juice made from concentrate should be regarded as containing added sugars depends on the juice's concentration and the sugar levels measured in Brix degrees.<sup>2</sup>

To mitigate the potential for hypothetical bias inherent to DCE, we followed two approaches that have proven effective in the literature. First, we included a cheap talk script similar to Champ et al. (2009) before the DCE scenarios. Second, we included a certainty scale after each scenario to gauge respondent confidence in their choice (Hensher et al., 2012). This study uses a 1–10 scale of certainty, where 1 = *extremely not certain*, and 10 = *extremely certain*. The average certainty scale was 8.33 across responses from all survey versions.

### 3.2 | Information treatments and hypothesis

To test the effect of different health- and diet-related information on the WTP for added sugars in dried cranberries and cranberry juice, we included four information treatments using a between-subjects design. Respondents were randomly assigned to one of the four information treatments. A complete description of the narrative included in each information treatment can be found in Supporting Information S1: Appendix C.

Treatment 1 was the no-information control. The intention of treatment 2 was to analyze if an explicit reminder about the health benefits of consuming cranberries would mitigate the negative effect from the added sugars reported on the NFP. We expected respondents' WTP to be higher under the positive information script (treatment 2) than the no information (treatment 1):

<sup>1</sup>We clarify that our study is not aimed at testing differences in the WTP for added sugars across various juice types. Our emphasis lies in examining respondents' perceptions of added sugars within the context of different cranberry juice denominations.

<sup>2</sup>To still be able to capture preferences for added sugars when the option was 100% juice, we did not restrict the 100% juice to always have 0 g added sugars in our experiment to allow for some variation in the added sugar attribute. According to FDA (US Food and Drug Administration, 2013), a nonjuice ingredient can be added to 100% juice if the ingredient does not dilute the juice, given the total solids necessary (Brix) for a full-strength juice.

$$H_{01} : WTP_{AS}^{\text{treatment 2 [health benefits]}} \leq WTP_{AS}^{\text{treatment 1 [control]}}$$

$$H_{a1} : WTP_{AS}^{\text{treatment 2 [health benefits]}} > WTP_{AS}^{\text{treatment 1 [control]}}$$

Treatment 3 seeks to investigate the effect of health recommendations to limit the consumption of added sugars on respondents' reactions to the added sugars reported on the NFP. We anticipated that the presentation of recommendations to limit sugar intake (negative information script) would exacerbate the effect of the added sugar line on the NFP of cranberry products. Presenting the negative information script (treatment 3) would result in a lower WTP when compared to the no-information (treatment 1):

$$H_{02} : WTP_{AS}^{\text{treatment 3 [limiting sugar intake]}} \geq WTP_{AS}^{\text{treatment 1 [control]}}$$

$$H_{a2} : WTP_{AS}^{\text{treatment 3 [limiting sugar intake]}} < WTP_{AS}^{\text{treatment 1 [control]}}$$

Finally, treatment 4 consisted of the information scripts from treatments 2 and 3. Our research question concerns whether information on the health benefits of consuming cranberries offsets the impact of information on the recommendation to limit added sugar consumption. Here, we test if equality in WTP under treatment 4 and the control can be rejected:

$$H_{03} : WTP_{AS}^{\text{treatment 4 [health benefits+limiting sugar intake]}} = WTP_{AS}^{\text{treatment 1 [control]}}$$

$$H_{a3} : WTP_{AS}^{\text{treatment 4 [health benefits+limiting sugar intake]}} \neq WTP_{AS}^{\text{treatment 1 [control]}}$$

## 4 | EMPIRICAL APPLICATION

This study applies the theory of demand that postulates that the utility derived from consuming a good stems from the attributes of the good, instead of the good itself (Lancaster, 1966). Empirically, we estimate consumer preferences for cranberry products based on the random utility theory (McFadden, 1974). The utility function is represented by

$$U_{njt} = \beta_n x_{njt} + \varepsilon_{njt}, \quad (1)$$

where  $U_{njt}$  is the utility derived by individual  $n$  when choosing alternative  $j$  in choice scenario  $t$ ;  $x_{njt}$  is a vector of observed attributes (i.e., added sugars reported on the NFP, sweetening method, and the price attribute);  $\beta_n$  is a vector of parameters to be estimated; and  $\varepsilon_{njt}$  is an unobserved error term that is assumed to be identically and independently distributed (Train, 2009).

This study applies the WTP space estimation by using the generalized multinomial logit model (GMNL) by Fiebig et al. (2010) by allowing for scale heterogeneity, that is,  $\beta_n = \sigma_n \beta + [\gamma + (1 - \gamma) \sigma_n] \eta_n$ . The GMNL model incorporates consumers' preference heterogeneity as follows:

$$U_{njt} = [\sigma_n \beta + \gamma \eta_n + (1 - \gamma) \sigma_n \eta_n] x_{njt} + \varepsilon_{njt}, \quad (2)$$

where  $\sigma_n$  is the individual-specific scale of the idiosyncratic error term that represents the scale heterogeneity, which follows a log-normal distribution with mean  $\bar{\sigma}$  and standard deviation  $\tau$ .  $\eta_n$  is the vector of individual specific taste that represents the individual's residual preference

heterogeneity, and  $\gamma$  is a parameter between 0 and 1 that controls how the variance of residual taste heterogeneity  $\eta_n$  varies with the scale heterogeneity  $\sigma_n$ .

The GMNL model is classified based on the values the parameter  $\gamma$  takes. If  $\gamma = 1$ , the standard deviation of the residual taste heterogeneity is independent of the scale and we get the GMNL Type I or GMNL-I. If  $\gamma = 0$ , we get the GMNL Type II or GMNL-II, where the standard deviation of the residual taste heterogeneity is proportional to the scale. We estimated both specifications and opted for presenting the results from the GMNL-II model given the superior goodness-of-fit statistics based on the Akaike information criterion (AIC), Bayesian information criterion (BIC), and log-likelihood function values. Based on the variables used in this study, and considering  $\gamma = 0$ , Equation (2) can be expressed as

$$U_{njt} = \beta_{ASC_{nj}} ASC_{nj} + \sigma_n (-Price_{njt} + \beta_{AS,n} AdSugar_{njt} + \beta_{SMS,n} SMSugar_{njt} + \beta_{SMJ,n} SMJuice_{njt} + \mathbf{L}\eta_n) + \varepsilon_{njt}, \quad (3)$$

where  $\beta_{ASC_{nj}}$  is the alternative-specific constant parameter estimate, and  $ASC_{nj}$  captures persistence unobserved attributes, for each individual  $n$ , option  $j$ . For the dried cranberry and unlabeled juice DCEs, the  $\beta_{ASC_{nj}}$  denotes the opt-out option. However, for the labeled cranberry juice, the ASCs denote whether the product evaluated is 100% juice, cocktail, or juice blend.<sup>3</sup> Note that the ASC can enter the equation in two forms, either scaled or unscaled. In this study, we opted for unscaled ASCs following the specifications in Balogh et al. (2016), Rahman and Bohara (2023), Yang (2021), Kunwar et al. (2020), Gu et al. (2013), Sarrias and Daziano (2017), Nguyen et al. (2021), Greene (2012), and Fiebig et al. (2010).  $Price_{njt}$  is a continuous variable that takes any of the three values from the experimental design and whose coefficient takes a fixed value of  $-1$  (meaning that the coefficient of  $-Price_{njt}$  has been normalized to 1). By normalizing the coefficient of  $-Price_{njt}$  to 1, we can directly interpret the coefficients of other nonprice attributes as the WTP estimates.  $AdSugar_{njt}$  is a continuous variable indicating the amount of added sugars per serving, and  $SMSugar_{njt}$  and  $SMJuice_{njt}$  are binary variables indicating that the method used to sweeten the cranberry products was regular sugar or juices from other fruits, respectively.  $\eta_n$  is the residual taste heterogeneity that follows a standard normal distribution and  $\mathbf{L}$  is the lower triangular matrix of the Cholesky decomposition (Luckstead et al., 2022). All models were estimated using the “gmln” package (Sarrias & Daziano, 2017) in R 4.0.5.

The self-reported response certainty scale was incorporated in the estimation of parameters, specifically in the scale parameter  $\sigma_n$  for each individual, following Kunwar et al. (2020):

$$\sigma_n = \exp(\delta certain_n + \tau v_n), \quad (4)$$

where  $\delta$  is the parameter of the observed heterogeneity in the scale term,  $\tau$  is the coefficient on the unobserved scale heterogeneity,  $v_n \sim N(0,1)$ , and  $certain_n$  is an indicator variable equal to 1 if individual  $n$ 's certainty scale is greater or equal to 7 and 0 otherwise. In our study, we employed a certainty scale threshold of 7<sup>4</sup> to align with the threshold levels used in prior research. Specifically, Champ et al. (2009) used a threshold of 7, while Bech et al. (2011) opted for a threshold of 8. We compared the specification reported in our results—where we allowed the mean of the scale parameter to vary across respondents according to their stated level of

<sup>3</sup>For the case of labeled cranberry juice,  $j$  = juice blend, cocktail, and 100% juice. These  $ASC_j$  represent the persistent unobserved attributes associated with each juice type or the marginal utility for each juice that were not captured by the attributes included in the model.

<sup>4</sup>In our sample, 17.33%, 12.00%, 16.60%, and 16.87% of responses in treatments 1–4 have a certainty level less than 7 for the dried cranberries survey, respectively; 17.53%, 14.53%, 17.00%, and 14.73% of responses in treatments 1–4 have a certainty level less than 7 for the unlabeled cranberry juice survey; 10.80%, 10.07%, 10.20%, and 8.93% of responses in treatments 1–4 have a certainty scale less than 7 for the labeled cranberry juice survey.

certainty—to a specification where the scale parameter was not stated as a function of certainty scale. The results led us to conclude that incorporating certainty scale improved the goodness-of-fit of the estimated models.

## 5 | RESULTS

The sociodemographic characteristics of the respondents to the dried cranberries and cranberry juice survey versions across four information treatment groups are included in Supporting Information S1: Appendix D.

### 5.1 | WTP results

Tables 2–4 present WTP estimates for dried cranberries and unlabeled and labeled juice across all information treatments. In the models reported, random parameters were allowed to be correlated.

#### 5.1.1 | Dried cranberries

Our findings show that, under the control/no information treatment, an extra gram of sugar added reduced respondents' WTP by \$0.20/6-oz. bag of dried cranberries (Table 2). Regarding the WTP for sweetening methods, respondents were indifferent between a product sweetened with a combination of fruit juices and regular sugar and just regular sugar. When we examined the WTP for added sugars across information effects, results showed that the WTP for increases in added sugar under treatment two was not statistically larger from the WTP under the control (fail to reject  $H_{01}$ ). This finding implies that information about the health benefits associated with dried cranberries does not mitigate the decreased WTP for increases in added sugars. On the other hand, the WTP for added sugars under treatment 3 was less than under the control (fail to reject  $H_{02}$ ). This result suggests that when information about recommendations to limit the consumption of added sugars was presented to respondents, they became more sensitive to the added sugar content, resulting in a lower WTP. When both sets of information were included, the WTP for increases in added sugars was less than the control (reject  $H_{03}$ ). This result emphasizes that, for dried cranberries, information on cranberries' health benefits does not mitigate the effect of the information about the recommendation to limit added sugar consumption.

The opt-out ASC was negative, indicating respondents preferred the cranberry product alternatives presented in the discrete choice scenarios over the no-buy option. The standard deviation of coefficient estimates for added sugar and sweetening method were statistically significant indicating respondents' heterogeneity in preferences. The coefficient estimates for scale heterogeneity,  $\tau$ , was statistically significant suggesting the presence of scale heterogeneity across respondents' choices.

The parameter estimate for the certainty variable was statistically significant and negative, indicating that respondents' choices were influenced by their stated level of choice certainty. The negative certainty coefficient suggests respondents who are certain about their choices made more stochastic choices. This is in contrast with results from previous studies which found that response certainty had a positive effect on scale factor (Beck et al., 2013; Kunwar et al., 2020). This result could be attributed to the hypothetical nature of DCEs.

### 5.1.2 | Unlabeled juice

Respondents' WTP was  $-\$0.13/64\text{-oz.}$  bottle for marginal increases in added sugar (Table 3). On the sweetening method, respondents' WTP for the cranberry juice sweetened with a combination of other fruit juices and regular sugar was larger than when the juice was sweetened with regular sugar only.

With regard to the effect of cranberry health benefits information on the WTP for added sugars, we found that the WTP under treatment two was not statistically less than the WTP under the control, indicating that this information did not mitigate the decreased WTP for added sugars (fail to reject  $H_{01}$ ). Similarly, receiving information on the recommendation to limit the consumption of added sugars had no effect on respondents' decreased WTP for increases in added sugars in the unlabeled juice (fail to reject  $H_{02}$ ). However, when both sets of information were presented to respondents, the stated WTP for added sugars was statistically less than under the control (fail to reject  $H_{03}$ ). This implies that the information on the health benefits of consuming cranberries did not offset the effect of the information on the recommendation to limit sugar intake on respondents' WTP for added sugars.

### 5.1.3 | Labeled juice

Respondents' WTP for marginal increases in added sugar was  $-\$0.11/64\text{-oz.}$  bottle for marginal increases in the added sugar<sup>5</sup> (Table 4). This result implies that expectations for added sugar differ if consumers are presented with generic juice choices compared to when they are presented with different type of juices available in the market. For the sweetening method, respondents were indifferent between a product sweetened with a combination of fruit juices from concentrate and regular sugar and just regular sugar. In summary, respondents consistently stated a lower WTP for increases in added sugars in cranberry products. These findings are consistent with Harkness and Areal (2018), who found that consumers prefer baby foods with “no added sugar,” and Spalding and Kiesel (2018), who found that consumers are willing to pay a premium for locally produced products with “no added sugar” labels. Further, a 2016 report by Chicago-based Euromonitor International reported a drop in fruit and vegetable juice sales volumes. It attributed this decline to consumers' increasing aversion to added sugars and artificial ingredients (Del Buono, 2017).

When considering the information effects, the WTP for added sugars under the health benefits information treatment was not significantly larger than the WTP under the control (fail to reject  $H_{01}$ ). The WTP under the information treatment on limiting sugar intake was not statistically lower than the WTP under the control (fail to reject  $H_{02}$ ). When respondents were presented with both sets of information (treatment four), the stated WTP for increases in added sugars ( $-\$0.14$ ) was different from the  $-\$0.11$  stated when they received no information (reject  $H_{03}$ ). These results are consistent with findings for the unlabeled cranberry juices; implying that respondents show a similar behavior towards labeled and unlabeled juices when presented with different sets of information. Also, consistently across the three products analyzed, the effect of the beneficial health claims associated with cranberry consumption did not offset the impact of the added sugar labeling. When comparing the WTP for added sugar across each treatment, the WTP in the labeled juice experiment were larger than the WTP for the unlabeled juice under treatments 3 and 4, but not under treatment 2 (see footnote 5). This result implies that the WTP for added sugar when presented with an unlabeled and labeled juice type is different when there is no information and when

<sup>5</sup>Just for context, not with the intention to make direct comparisons, we conducted a pairwise *t*-test between the WTP for added sugars for the unlabeled and the labeled juice. Results show that the WTP for added sugars for the labeled is significantly lower than the WTP for added sugars for the unlabeled juice. Results for the *t*-tests comparing the WTP for the sweetening methods between the labeled and unlabeled juice types are available upon request.

**TABLE 2** Coefficient estimates across dried cranberries, considering information effects using the GMNL-II model in WTP space.

Variables	Coefficient estimates				Difference between WTP <sup>a</sup>		
	T1 <sup>b</sup>	T2 <sup>b</sup>	T3 <sup>b</sup>	T4 <sup>b</sup>	T2 – T1	T3 – T1	T4 – T1
Mean willingness to pay (\$/6-oz. bag)							
Marginal increase in added sugar	-0.20*** <sup>c</sup> (0.02) <sup>d</sup>	-0.22*** (0.03)	-0.25*** (0.03)	-0.28*** (0.03)		**	***
Sweetening method: Regular sugar <sup>e</sup>	0.32 (0.31)	0.16 (0.35)	0.80** (0.34)	-0.35 (0.37)			**
Sweetening method: Other fruit juices from concentrate <sup>e</sup>	0.87*** (0.24)	0.69** (0.29)	0.30 (0.28)	-0.20 (0.32)		***	***
Opt-out	-6.45*** (0.42)	-5.73*** (0.39)	-5.60*** (0.34)	-5.26*** (0.34)			
Standard deviation							
Marginal increase in added sugar	0.23*** (0.03)	0.23*** (0.03)	0.17*** (0.03)	0.30*** (0.04)			
Sweetening method: Regular sugar <sup>e</sup>	2.15*** (0.45)	0.11 (0.55)	0.70 (0.66)	1.09** (0.49)			
Sweetening method: Other fruit juices from concentrate <sup>e</sup>	1.84*** (0.36)	1.62*** (0.47)	1.29*** (0.41)	1.55*** (0.48)			
Opt-out	2.07*** (0.42)	0.39 (0.71)	1.38** (0.68)	0.26 (0.76)			
Scale heterogeneity ( $\tau$ )	1.09*** (0.10)	1.04*** (0.09)	1.05*** (0.10)	1.10*** (0.09)			
Certain	-0.35*** (0.08)	-0.81*** (0.10)	-0.66*** (0.09)	-0.71*** (0.09)			
Number of observations	1500	1500	1500	1500			
Log likelihood	-1180.30	-1176.03	-1194.93	-1217.68			
AIC <sup>f</sup>	2392.60	2384.06	2421.86	2467.36			
BIC <sup>f</sup>	2477.61	2469.08	2506.87	2552.37			

Abbreviations: GMNL, generalized multinomial logit model; WTP, willingness to pay.

<sup>a</sup>Statistical significance corresponds to *t*-test conducted for comparing WTP between information treatments and control (treatment 1):

$H_{01} : WTP_{AS}^{\text{treatment 2 [health benefits]}} \leq WTP_{AS}^{\text{treatment 1 [control]}}$ ,  $H_{02} : WTP_{AS}^{\text{treatment 3 [limiting sugar intake]}} \geq WTP_{AS}^{\text{treatment 1 [control]}}$ ,

and  $H_{03} : WTP_{AS}^{\text{treatment 4 [health benefits+limiting sugar intake]}} = WTP_{AS}^{\text{treatment 1 [control]}}$ .

<sup>b</sup>T1, T2, T3 and T4 correspond to treatment 1 (no-information control), treatment 2 (information on health benefits from cranberries), treatment 3 (information on recommendation to limit added sugar consumption), and treatment 4 (information from T2 and T3), respectively.

<sup>c</sup>Single, double, triple asterisks (\*, \*\*, and \*\*\*) indicate statistical significance at the 10%, 5%, and 1% levels.

<sup>d</sup>Standard errors are given within parentheses.

<sup>e</sup>The sweetening method combination of fruit juices from concentrate + regular sugar was used as the reference level.

<sup>f</sup>AIC is the Akaike information criterion and BIC is the Bayesian information criterion, both are measures of goodness of fit.

**TABLE 3** Coefficient estimates across unlabeled cranberry juice, considering information effects using the GMNL-II model in WTP space.

Variables	Coefficient estimates				Difference between WTP <sup>a</sup>		
	T1 <sup>b</sup>	T2 <sup>b</sup>	T3 <sup>b</sup>	T4 <sup>b</sup>	T2 - T1	T3 - T1	T4 - T1
Mean willingness to pay (\$/64 oz. bottle)							
Marginal increase in added sugar	-0.13*** <sup>c</sup> (0.01) <sup>d</sup>	-0.16*** (0.02)	-0.14*** (0.02)	-0.21*** (0.04)			***
Sweetening method: Regular sugar <sup>e</sup>	-0.65*** (0.24)	0.19 (0.27)	0.07 (0.19)	0.04 (0.31)	***		***
Sweetening method: Other fruit juices from concentrate <sup>e</sup>	0.38** (0.18)	0.35 (0.23)	0.35** (0.17)	0.40 (0.26)			
Opt-out	-5.70*** (0.31)	-4.70*** (0.29)	-6.16*** (0.30)	-4.98*** (0.32)			
Standard deviation							
Marginal increase in added sugar	0.12*** (0.02)	0.20*** (0.03)	0.16*** (0.02)	0.21*** (0.04)			
Sweetening method: Regular sugar <sup>e</sup>	0.46 (1.18)	1.24** (0.61)	0.99*** (0.35)	0.06 (1.46)			
Sweetening method: Other fruit juices from concentrate <sup>e</sup>	1.33*** (0.26)	1.32*** (0.38)	1.33*** (0.30)	1.70*** (0.46)			
Opt-out	1.47*** (0.36)	0.99** (0.45)	0.25 (0.81)	0.34 (0.79)			
Scale heterogeneity ( $\tau$ )	0.67*** (0.08)	0.91*** (0.11)	0.69*** (0.07)	1.09*** (0.11)			
Certain	-0.32*** (0.07)	-0.54*** (0.09)	-0.27*** (0.07)	-0.75*** (0.12)			
Number of observations	1500	1500	1500	1500			
Log likelihood	-1205.68	-1264.85	-1188.20	-1238.79			

(Continues)

TABLE 3 (Continued)

Variables	Coefficient estimates				Difference between WTP <sup>a</sup>					
	Information treatments				T2 – T1		T3 – T1		T4 – T1	
	T1 <sup>b</sup>	T2 <sup>b</sup>	T3 <sup>b</sup>	T4 <sup>b</sup>						
AIC <sup>f</sup>	2443.36	2561.70	2408.40	2509.59						
BIC <sup>f</sup>	2528.37	2646.71	2493.42	2594.60						

Abbreviations: GMNL, generalized multinomial logit model; WTP, willingness to pay.

<sup>a</sup>Statistical significance corresponds to *t*-test conducted for comparing WTP between information treatments and control (treatment 1):  $H_0: WTP_{AS,treatment\ 2} [health\ benefits] \leq WTP_{AS,treatment\ 1(control)}$ ,

$H_02: WTP_{AS,treatment\ 3} [limiting\ sugar\ intake] \geq WTP_{AS,treatment\ 1(control)}$ , and  $H_03: WTP_{AS,treatment\ 4} [health\ benefits+limiting\ sugar\ intake] = WTP_{AS,treatment\ 1(control)}$ .

<sup>b</sup>T1, T2, T3, and T4 correspond to treatment 1 (no-information control), treatment 2 (information on health benefits from cranberries), treatment 3 (information on recommendation to limit added sugar consumption), and treatment 4 (information from T2 and T3), respectively.

<sup>c</sup>Single, double, and triple asterisks (\*, \*\*, \*\*\*) indicate statistical significance at the 10%, 5%, and 1% levels.

<sup>d</sup>Standard errors are given within parentheses.

<sup>e</sup>The sweetening method combination of fruit juices from concentrate + regular sugar was used as the reference level.

<sup>f</sup>AIC is the Akaike information criterion and BIC is the Bayesian information criterion, both are measures of goodness of fit.

**TABLE 4** WTP across labeled cranberry juice, considering information effects using the GMNL-II model in WTP space.

Variables	Coefficient estimates				Difference between WTP <sup>a</sup>		
	T1 <sup>b</sup>	T2 <sup>b</sup>	T3 <sup>b</sup>	T4 <sup>b</sup>	T2 - T1	T3 - T1	T4 - T1
Mean willingness to pay (\$/64-oz. bottle)							
Marginal increase in added sugar	-0.11*** <sup>c</sup> (0.02) <sup>d</sup>	-0.15*** (0.03)	-0.09*** (0.02)	-0.14*** (0.03)			***
Sweetening method: Regular sugar <sup>c</sup>	-0.55 (0.42)	0.36 (0.42)	-0.12 (0.23)	0.05 (0.33)	***		***
Sweetening method: Other fruit juices from concentrate <sup>e</sup>	1.00*** (0.22)	1.31*** (0.34)	0.55*** (0.20)	0.63** (0.28)	***	***	**
100% Juice	6.39*** (0.41)	9.26*** (0.90)	8.45*** (0.62)	7.81*** (0.65)			
Cocktail	4.52*** (0.49)	6.95*** (0.91)	6.21*** (0.65)	5.61*** (0.71)			
Blend	4.63*** (0.47)	7.34*** (0.90)	7.07*** (0.62)	6.14*** (0.68)			
Standard deviation							
Marginal increase in added sugar	0.14*** (0.02)	0.09*** (0.02)	0.12*** (0.02)	0.20*** (0.04)			
Sweetening method: Regular sugar <sup>c</sup>	0.14 (0.41)	1.49*** (0.37)	0.14 (0.37)	0.23 (0.48)			
Sweetening method: Other fruit juices from concentrate <sup>e</sup>	1.13*** (0.41)	0.75* (0.45)	1.21*** (0.30)	1.58*** (0.43)			
100% Juice	0.59 (0.37)	1.27*** (0.49)	1.34*** (0.43)	0.89** (0.43)			
Cocktail	0.72 (0.67)	2.25*** (0.32)	2.38*** (0.31)	1.86*** (0.44)			
Blend	0.08 (0.62)	0.94** (0.44)	0.96* (0.53)	0.42 (0.69)			
Scale heterogeneity ( $\tau$ )	0.74*** (0.08)	1.41*** (0.17)	0.72*** (0.10)	0.78*** (0.11)			
Certain	-0.20** (0.08)	-0.54*** (0.11)	-0.03 (0.07)	-0.39*** (0.10)			
Number of observations	1500	1500	1500	1500			
Log likelihood	-1156.46	-1194.20	-1226.33	-1199.80			

(Continues)

TABLE 4 (Continued)

Variables	Coefficient estimates						
	Information treatments		Difference between WTP <sup>a</sup>				
	T1 <sup>b</sup>	T2 <sup>b</sup>	T3 <sup>b</sup>	T4 <sup>b</sup>	T2 - T1	T3 - T1	T4 - T1
AIC <sup>f</sup>	2370.92	2446.40	2510.65	2457.61			
BIC <sup>f</sup>	2525.01	2600.49	2664.73	2611.69			

Abbreviations: GMNL, generalized multinomial logit model; WTP, willingness to pay.

<sup>a</sup>Statistical significance corresponds to *t*-test conducted for comparing WTP between information treatments and control (treatment 1):  $H_{01} : WTP_{AS,treatment 2[health\ benefits]} \leq WTP_{AS,treatment 1[control]}$ ,  $H_{02} : WTP_{AS,treatment 3[limiting\ sugar\ intake]} \geq WTP_{AS,treatment 1[control]}$ , and  $H_{03} : WTP_{AS,treatment 4[health\ benefits+limiting\ sugar\ intake]} = WTP_{AS,treatment 1[control]}$ .

<sup>b</sup>T1, T2, T3, and T4 correspond to treatment 1 (no-information control), treatment 2 (information on health benefits from cranberries), treatment 3 (information on recommendation to limit added sugar consumption), and treatment 4 (information from T2 and T3), respectively.

<sup>c</sup>Single, double, and triple asterisks (\*, \*\*, \*\*\*) indicate statistical significance at the 10%, 5%, and 1% levels.

<sup>d</sup>Standard errors are given within parentheses.

<sup>e</sup>The sweetening method combination of fruit juices from concentrate + regular sugar was used as the reference level.

<sup>f</sup>AIC is the Akaike information criterion and BIC is the Bayesian information criterion, both are measures of goodness of fit.

recommendations to limit sugar intake are emphasized. But when the cranberry health benefits are emphasized, the WTP for the added sugar is similar across juice types. The WTP for the sweetening methods is also different for the labeled and unlabeled juice types except for the WTP for regular sugar addition relative to the combination of juice concentrate and regular sugar, under treatment 3 that was similar between the labeled and unlabeled juice type (see footnote 5). For the case of labeled juice, the ASC reflects the marginal utility for each juice type in the absence of any attribute. Here marginal utility derived from 100% juice is the largest, followed by juice blend and cocktail.

## 5.2 | Heterogeneity in consumers' preferences

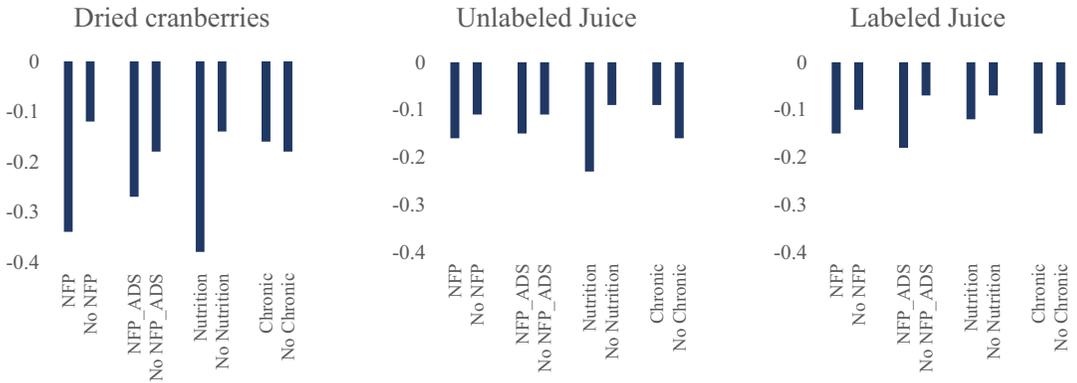
From a policy perspective, it is essential to examine the distributional effects of the added sugar declaration rule across different consumer segments to identify groups who are more likely to be impacted by the new labeling policy. As previous studies point out, consumers decide to either access or avoid information on added sugars depending upon characteristics inherent to the consumer and the food product (Kim et al., 2021). Thus, we investigate differences in the WTP for added sugar based on respondents' characteristics (Supporting Information S1: Appendix E). We estimated separate models for the subsamples identified and conducted pairwise t-tests on the bootstrapped WTP estimates. Note that this section uses only the responses to the control sample to avoid confounding the subsampling effects with the information effects. We focus our discussion on differences in the WTP for added sugars.

We present the summary statistics on respondents' sociodemographic characteristics across these subsample groups in Supporting Information S1: Appendix E. In sum, subsamples differing in their attention to the NFP information are reasonably similar in their sociodemographic composition. Surprisingly, the subsample of respondents for whom the added sugar information was the main piece of information exhibited a lower proportion of households with children<sup>6</sup> than their counterparts. The health and nutrition-conscious subsample had a higher income and larger proportion of families with children than their counterparts. The subsample with chronic health conditions had a higher proportion of males, a larger proportion of college-educated, income higher than average, and lower proportion of millennials compared with their counterparts.

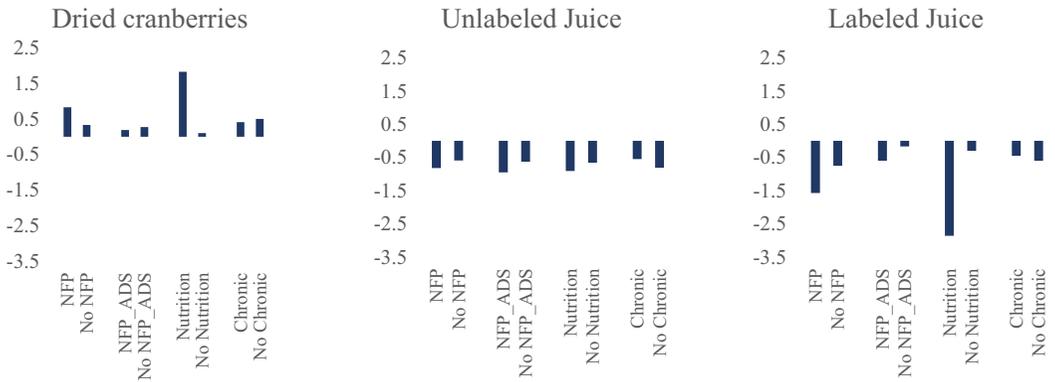
For the dried cranberry survey, 58% of respondents indicated that the NFP information is important to them and were more likely to read the information on the NFP of food products. These respondents stated a considerably lower WTP ( $-\$0.34$ ) for added sugars relative to those who did not declare the same interest in NFP information ( $-\$0.12$ ) (Figure 1 and Supporting Information S1: Appendix F). Similarly, respondents for whom added sugar is the main piece of information on the NFP (26% of the sample) exhibited lower WTP for added sugar ( $-\$0.27$ ) relative to respondents who did not attend this information on the NFP ( $-\$0.18$ ). Health and nutrition-conscious respondents (36% of the sample) also assigned significantly lower WTP for added sugars ( $-\$0.38$ ) relative to their nonnutrition-conscious counterparts ( $-\$0.14$ ). Interestingly, we did not find significant differences in the WTP for added sugars in dried cranberries between respondents who had been diagnosed with chronic illnesses (42% of the sample) and those who had not. This result is consistent for both unlabeled (Supporting Information S1: Appendix G) and labeled (Supporting Information S1: Appendix H) cranberry juice, where respondent segments who were more inclined to read NFPs (53% of the sample of respondents), who attend added sugar information on the NFP (23% of the sample), and who self-reported as nutrition and health conscious (37% of the sample) stated significantly lower WTP for added sugars, compared to their counterparts. The results for the subsample self-reporting diet-related chronic disease are mixed. For the unlabeled juice, there were

<sup>6</sup>Previous research indicates that individuals who have children exhibit greater familiarity with nutritional guidelines and are more inclined to utilize information pertaining to sugar content (Prada et al., 2020). Therefore, we incorporate the variable "presence of children" into the heterogeneity analyses.

Willingness to Pay for Added Sugars



Willingness to Pay for Sweetening Method: Regular Sugar



Willingness to Pay for Sweetening Method: Other Fruit Juices from Concentrate

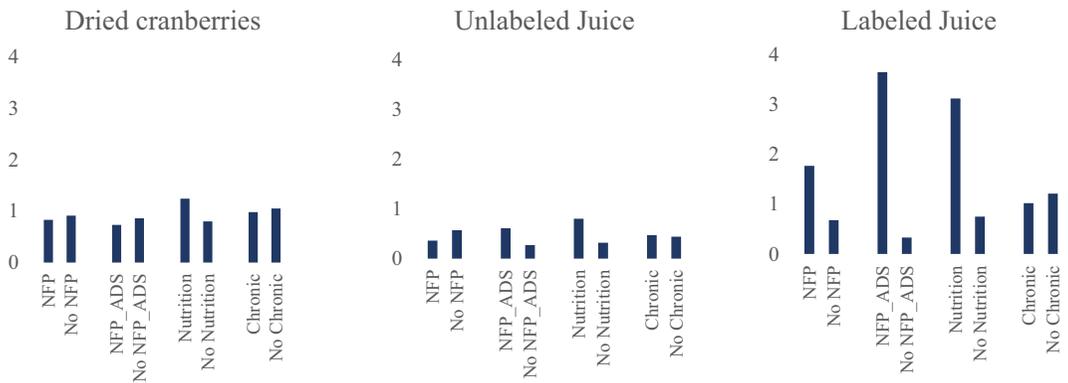


FIGURE 1 Heterogeneous WTP across different cranberry survey subsamples of respondents. Chronic, respondents who have been diagnosed with a diet-related chronic diseases; NFP, respondents for whom the information in the Nutrition Facts Panel (NFP) is important; NFP\_ADS, respondents for whom added sugars is the main piece of information in the NFP; nutrition, respondents who are nutrition conscious.

no differences in the WTP stated by both groups. Still, for the labeled juice, those self-reporting diet-related chronic disease stated a lower WTP compared to their counterpart.

## 6 | CONCLUSIONS

The US cranberry industry expressed concerns that the FDA regulation mandating the declaration of added sugars on the NFP of foods could affect consumers' demand. These concerns were not off-base; respondents in our study consistently stated a lower WTP for increases in added sugars in cranberry products. Our study also found that respondents preferred dried cranberries and cranberry juice sweetened with other fruit juices compared to the addition of regular sugar alone. Given these results, evaluating the economic trade-off between consumers' stated WTP for added sugars and the potential higher costs from sweetening cranberry products with juices from other naturally sweet fruits is timely.

This study found that consistently across the cranberry products analyzed, health claims do not offset the impact of the information on the dietary effects of consuming sugar, nor offset the decreased WTP for increases in added sugar. Further, the effect of information on the recommendation to limit added sugars and the benefit from limiting its consumption is larger compared to the effect of the health benefits associated with cranberry consumption.

Labeling policies are likely to have a more salient effect on respondents who already prioritize health and nutrition (Fang et al., 2019; Thunström, 2019). Our study proves that respondents who consider the information on the NFP critical for the purchase of cranberry products and those who regard nutrition to be the most influential factor in their food purchasing decisions assign lower WTP for added sugars and products sweetened with regular sugar. Also, the effectiveness of such policies depends on whether consumers read, understand, and use the information on the NFPs. Given that consumers do not always pay attention to the NFP, several consumer segments—and perhaps those segments to which health officials and policymakers intend to benefit—are likely to be unaffected by such labeling policies. Our study found that, depending on the cranberry product tested, respondents who would be expected to be more concerned from a health standpoint (i.e., consumers diagnosed with a diet-related chronic disease) adjust their demand by less (or the same) compared to healthier individuals.

In summary, this study enhances our understanding of the effectiveness of labeling policies regarding added sugar. It explores the unintended consequences of labeling mandates, including the potential for a negative perception of food products like cranberries, which are typically associated with health benefits. The significance of this study goes beyond cranberry products. We find that consumers tend to be stricter and more willing to reduce their WTP when products they perceive as healthy (like cranberries) have added ingredients that are considered negative, such as added sugars. Furthermore, even if the health benefits of a product are highlighted, once a negative component is disclosed, it tends to overshadow any positive aspects, even if they are made clear.

Finally, this study employed two methods to address hypothetical bias: the cheap talk and certainty scale. Yet, we acknowledge that our findings are derived from hypothetical decision-making scenarios. Future research should investigate other ways to mitigate hypothetical bias beyond what was done in this study, such as the use of virtual environments (Fang et al., 2021), use of experimental auctions, or explore retail sales data combined with stated preference data to better understand consumer attitudes towards the label change in products that need added sugars to be palatable.

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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